

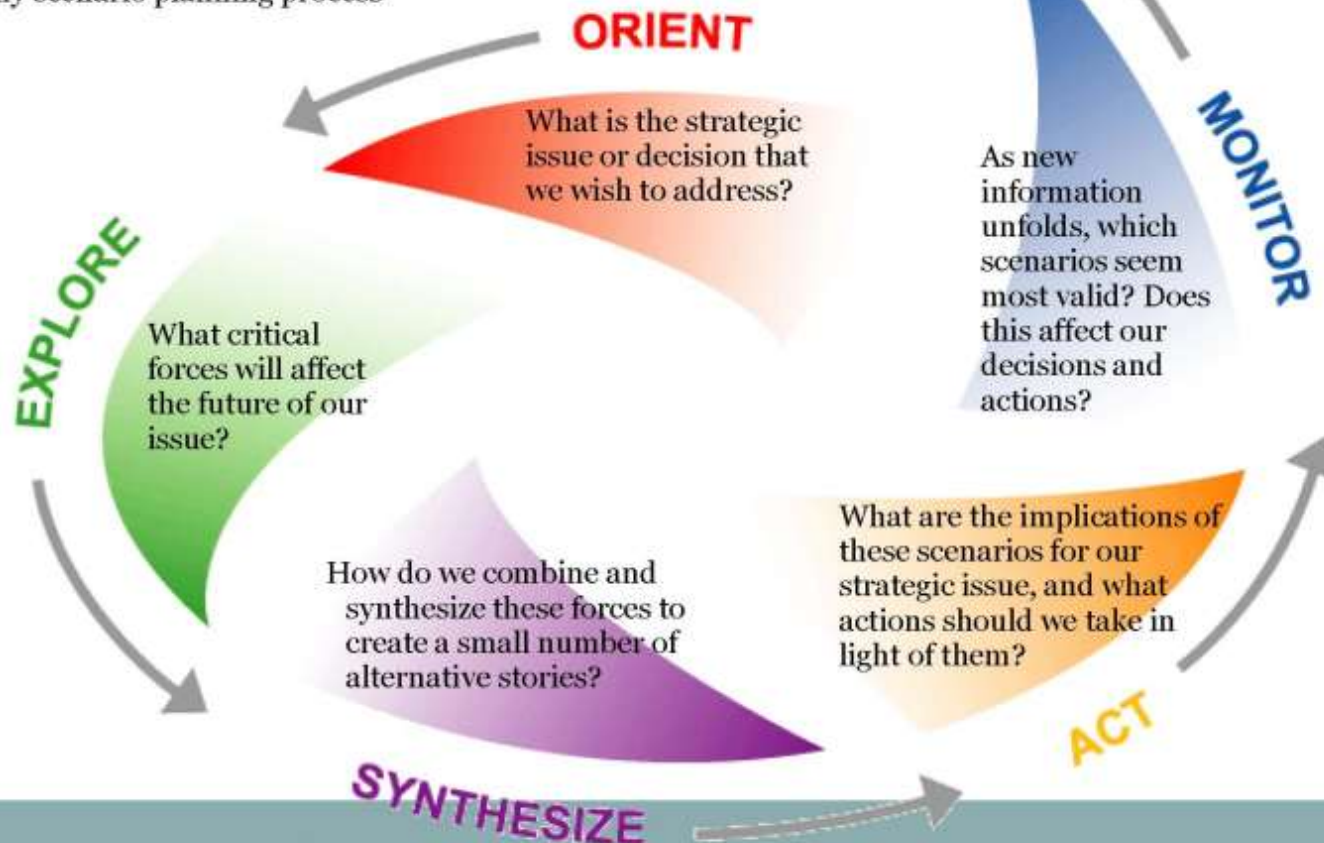


**National Park Service**



# Explaining Scenarios: A Basic GBN Scenario Creation Process

This diagram describes the 5 key steps required in any scenario planning process



Global Business Network (GBN) -- A member of the Monitor Group

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## National Parks of Alaska

# National Park Service







A FILM BY KEN BURNS

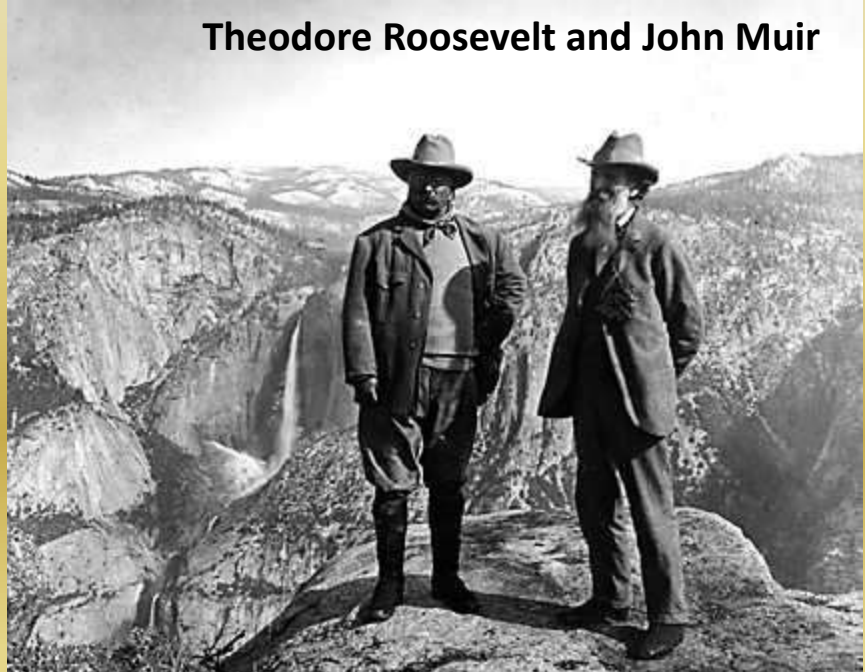
# THE NATIONAL PARKS

America's Best Idea

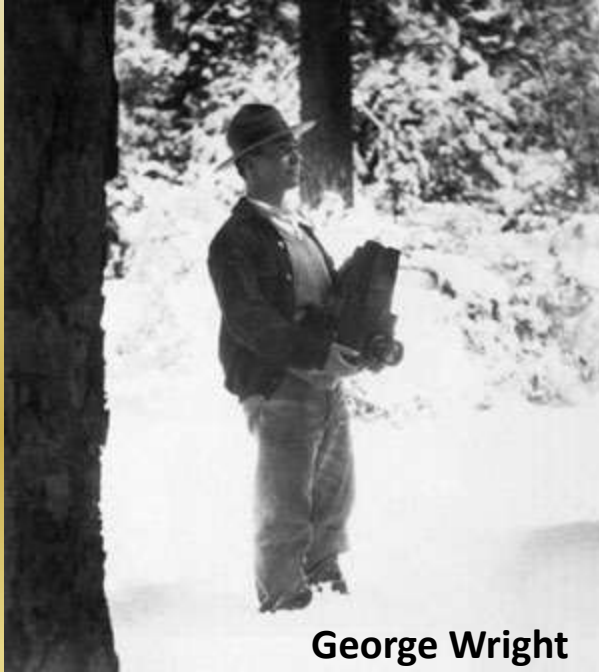
**National Park Service**



Theodore Roosevelt and John Muir



George Wright



Stephen Mather and Horace Albright

**National Park Service**





## 2011 Alaska Leadership Council



Joel Hard, Tim Hudson, Ralph Moore, Jeanette Pomrenke, John Quinley, Mary McBurney, Deb Cooper, Susan Boudreau, Jeff Mow, Sue Messia, Vic Knox, Meg Jensen, Randy Larsen, Chuck Young, Elwood Lynn, Mark Vaughn, Paul Anderson, and Greg Dudgeon.

## National Park Service Climate Change Response Strategy

DRAFT November 2009



# National Park Service

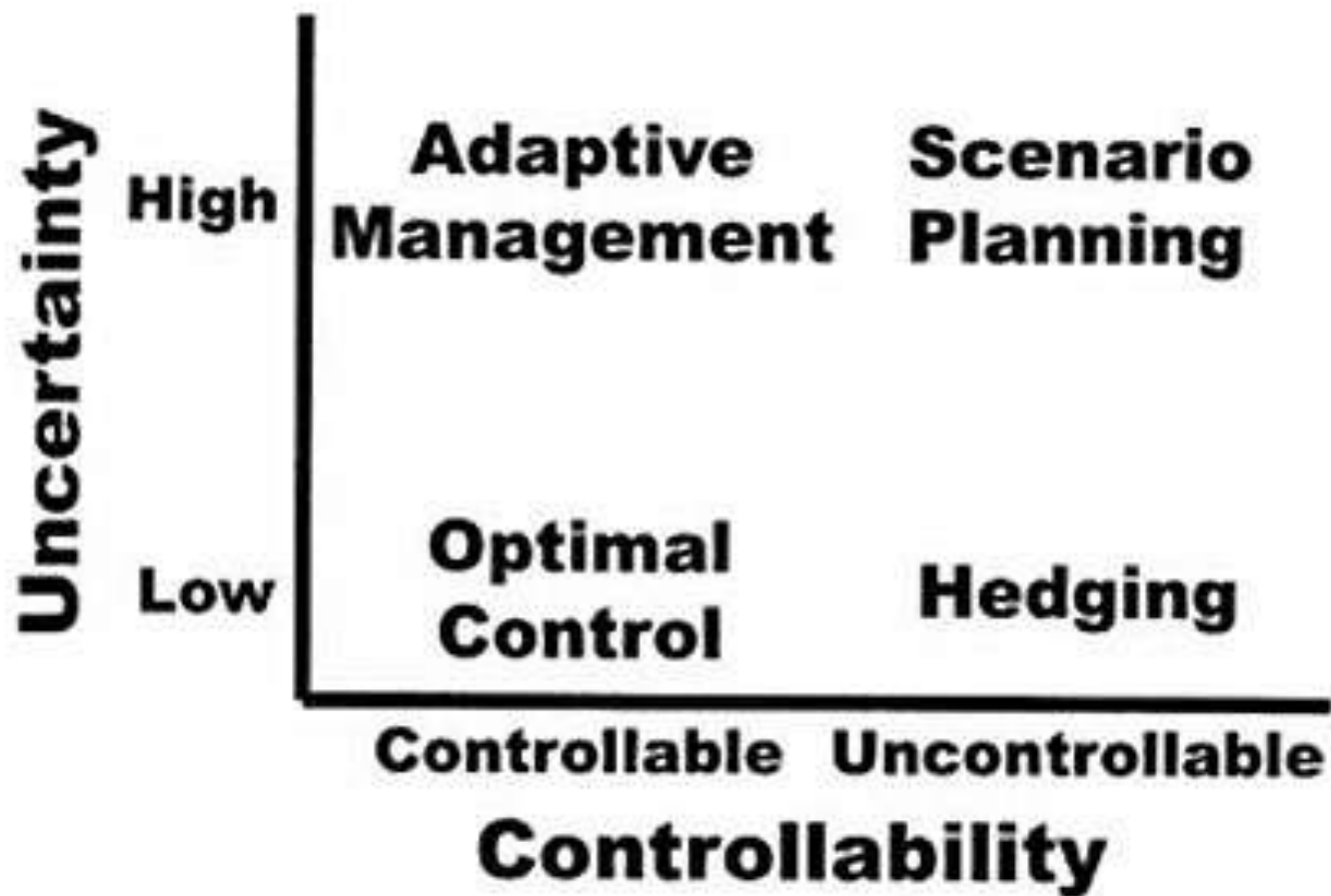


“We use scenario planning to rehearse the future to avoid the management surprises”

“Finally, the park system is going to scenario planning and seeing what places will be the most vulnerable and how to adapt. The new visitor center for the USS Arizona in Pearl Harbor is designed for a three-foot sea-level rise, as an example.”

Jon Jarvis, The Big Outside Blog, 12/21/2011





## Generating a Broad Range of Options

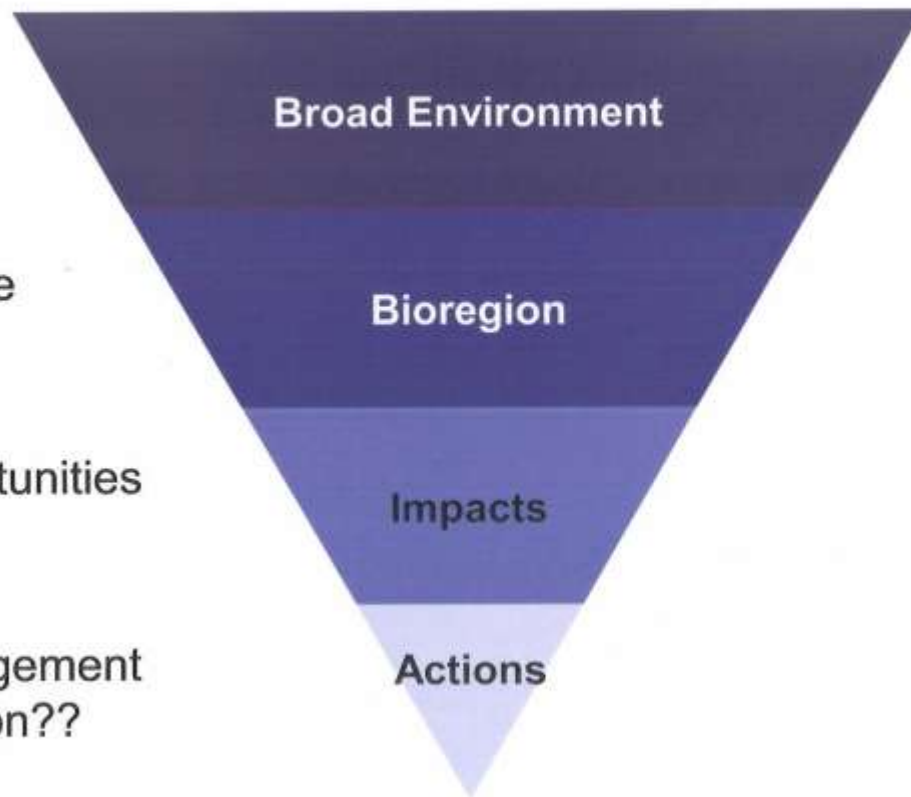
*For each scenario . . .*

What is this world like?

What effects does this have  
on the bioregion?

What pressures and opportunities  
will management face?

What could / should management  
do if faced with this situation??



### Implications

*The conditions under which you will need to operate*

Challenges

Bottlenecks

Shortages

Emergent needs

Emergent capabilities



### Options

*The range of actions you will take in light of the conditions*

Responses

Workarounds and fixes

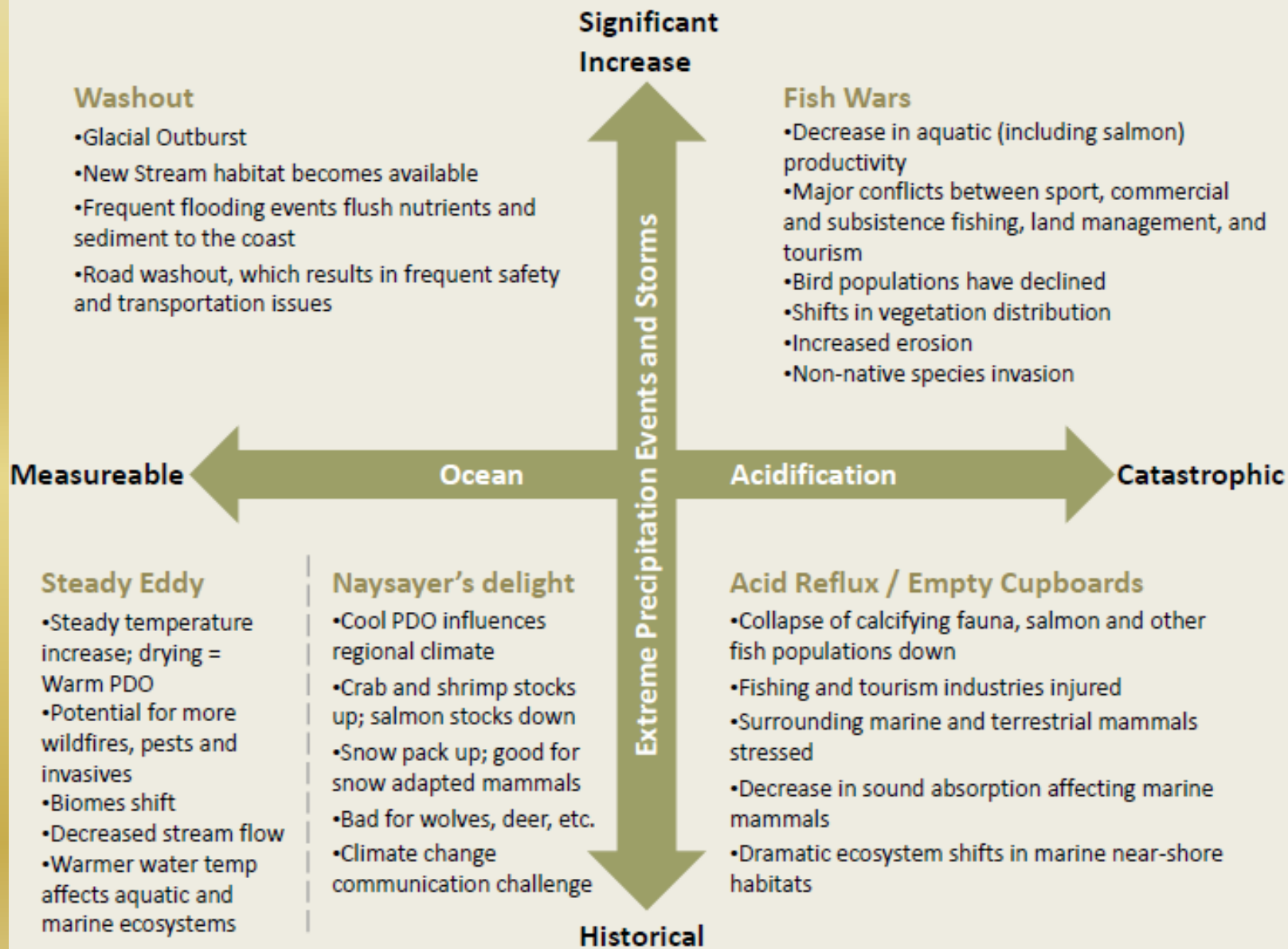
New supplies and suppliers

Product or service offerings

Specific investments, development activities







# Implications Nested Scenario 2: Acid Wash/Big Problems, Big Efforts: “Acid Reflex”

## Natural Resources

- benthic community decline , food web shift, local extinction, mass redistribution, coastal erosion, unknown glacial dynamics

## Cultural Resources

- flooding and wave action , loss of known historic sites, loss of historic record (undiscovered sites)

## Subsistence

- Loss of fish, game, “revenue” (community asset) , Shift in way of life, Search for surrogates

# Implications (continued)

## Socioeconomic

- Questions of prioritization re: private vs. public aid ,  
livelihoods stressed, leading to industry shift (tourism, fishing)

## Facilities

- Increased risk of flood/mudslide/erosion effects on structures,  
access to roads and trails more frequently compromised, ....

## Communication

- media/public involved at every step, need for a highly evolved  
communication network, potential misaligned message  
delivery



### Implications

*The conditions under which you will need to operate*

Challenges

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Emergent capabilities



### Options

*The range of actions you will take in light of the conditions*

Responses

Workarounds and fixes

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Specific investments, development activities



# Research and Information Needs

- Overall, more robust monitoring and research
- Acidification research
- Alternative energy/ alternative facilities research
- Exploratory husbandry
- Glacial monitoring
- Robust benthic, fish, seabird, mammal monitoring
- Mapping of cultural resources
- Coastal engineering



# Important Management Actions

- Mission Statement evolution
- Removal of artificial barrier between research/monitoring/management loop
- Fostering public/private partnerships (e.g. ecosystem cooperatives/LCCs)
- Protecting and providing access to sacred cultural sites
- Comprehensive risk assessment for roads, bridges, trails, structures
- Temporary/portable facilities
- Species specific mitigation planning (economic driver species)
- Foster transitional community coping mechanisms
- Synchronize public/private education and outreach





# Southwest Alaska Network

## Background

Since 2006 the National Park Service (NPS) has been using scenario planning, a collaborative and strategic science-based decision support tool, to explore future impacts of global climate change, management policies and societal attitudes on national parks. The NPS has engaged several leaders in the field of scenario planning in this effort, most notably the Global Business Network, the University of Alaska's Scenarios Network for Alaska Planning, the University of Arizona's Office of Arid Lands Studies, the University of Montana National Center for Landscape Fire Analysis and the USGS Northern Prairie Wildlife Research Center. With the aid of these partners, the NPS has developed a unique approach to scenario planning, which employs quantitative as well as qualitative models of change to envision a variety of future social, political and environmental outcomes. By applying the process of scenario planning, NPS managers are able to evaluate the uncertainty and variability surrounding future environmental and sociopolitical conditions, and develop resource management strategies that will be effective across a wide range of potential outcomes.

## Southwest Alaska Network Local Climate Drivers

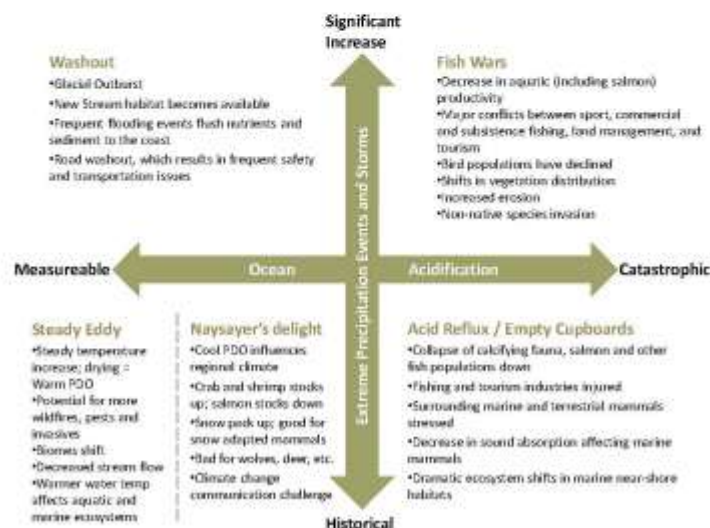
The Southwest Alaska Network scenario workshop participants identified extreme precipitation events and storms and ocean acidification as the most critical and uncertain climate drivers that will affect conditions in the network over the next 50 to 100 years. These drivers were used to create a local climate change drivers matrix where impacts to park resources and infrastructure could be identified and elevated for additional consideration. Based on the local climate drivers matrix, four narrative scenarios were developed, which incorporate the potential impacts of climate change to park resources set in the context of varying future social and political situations.

## Scenario #1 – NPS 911

"NPS 911" is a scenario where southwest Alaska is experiencing an increase in extreme storm and precipitation events. These events cause frequent flooding that flushes nutrients and sediment to the coast, increases erosion and encourages vegetation succession on land - which has allowed for invasive species encroachment in terrestrial ecosystems. Roads are prone to washout, resulting in safety and transportation issues. Increased water temperatures in lakes and streams stress salmon populations. This scenario offers a lack of senior commitment and governments are unable to articulate a coherent set of policies and approaches to climate change, resulting in growing public unease, and unstable systems and structures. Impacts and Implications of this scenario may include cultural resources at risk of flooding and damage and emergency documentation of archeological sites would be necessary. This scenario would be characterized by an increase in the need of community support and assistance from the NPS. Facilities and infrastructure would likely suffer damage, and there would likely be an increase in travel risks and incidents. This scenario would present a challenge for interpretation and education in the form of reduced visitor satisfaction and heightened expectations of climate change response from the NPS.



April 2011



## Scenario #2 – Jellyfish Delight

"Jellyfish Delight" is a scenario where catastrophic increases in ocean acidification, coupled with extreme storm and precipitation events, have resulted in a decrease in aquatic (example: salmon) productivity. Major conflicts between sport, commercial, and subsistence fishing, land management, and tourism are common. Bird populations have declined due to decreased food availability and the loss of breeding habitat from flooding. However, broad societal understanding of climate change spurs coordinated action leading political leaders to initiate bold policies to mitigate the worst impacts of climate change, and adapt to the inevitabilities of climate change effects. Impacts and implication of this scenario would likely be characterized by severe stress to wildlife, especially aquatic wildlife. Coastal fish population could approach collapse, resulting in severe economic impacts and produce heated conflicts. Cultural resources, historic buildings, archaeological sites, facilities and roads could suffer flooding and erosion. It is likely that visitation would decline as a result of the reductions in charismatic species.



## Scenario #4 – "What Climate Change"

"What Climate Change" is a wild card scenario where winter temperatures are lower during a negative phase of the Pacific Decadal Oscillation, combined with a measurable level of ocean acidification. Impacts and implications of this scenario would include climate change becoming a topic of little political or societal concern, as competing concerns and interests dominate public discourse. Southwest Alaska experiences a large marine shift as a result of the changes. Crab and shrimp stocks have increased, while salmon stocks have declined. This effect has caused brown bear declines. Snow pack may increase, resulting in ideal conditions for skiers, moose, and other mammals adapted to large snow cover. Wolves and their prey do not do as well in the deep snow. Potential for changes to the terrestrial ecosystems arise. Subsistence and commercial fishing is affected as more people compete for fewer fish. Interpretation and education would face significant challenges in communicating the implications of climate change to the public when climatic changes are not apparent, due to wetter, cooler weather.

"Best Practices" The following strategies, actions, and areas for further study were common to all four Southwest Alaska Network scenarios, and represent "best practices", as they will enable managers to better approach resource management regardless of how the future may unfold. Moreover, the indicators to monitor areas for further research represent milestones that could signal whether the future is evolving towards or away from one or more scenarios, allowing managers to adjust strategies and actions accordingly.

## Scenario #3 – Baked Alaska

Baked Alaska is a scenario of relatively slow increase in ocean acidification, coupled with a historical trend of extreme storm and precipitation events. This scenario is characterized by strong commitment from leadership and the international community regarding climate change action. However, there are other concerns competing with climate change, and society remains largely indifferent to action.

There are few major changes in species composition and productivity along the coasts, although steady temperature increases have altered the terrestrial environment, causing increases in wildfires and pests, such as beetle kill, which continue to affect the landscape. Vegetation biomes have shifted, creating opportunities for the encroachment of invasive species. Stream volumes are decreasing, drying up many wetland and riparian areas; while rising water temperatures affect fish reproduction, and in turn, marine and terrestrial mammal populations.

Impacts and Implications: there would likely be an increase in fires, pests and stress to vegetation. Due to increases in temperature, there would likely be a small window of time to preserve snow bed archaeology relative to other scenarios. Summer tourism would likely increase with the longer visitation season and winter travel would be reduced with more open water.



## "Best Practices" Management Actions Common and Applicable to All Scenarios

Resiliency	Research and Study
<ul style="list-style-type: none"> <li>Make Climate Change an organizing principle for park priorities.</li> <li>Reduce stressors: control invasives, restore disturbed areas.</li> <li>Coordinate emphasis on inventory and monitoring of both social and natural systems.</li> </ul>	<ul style="list-style-type: none"> <li>Safety and access changes.</li> <li>Role of natural variability.</li> <li>Park relevance with public and visitors under changing conditions.</li> <li>Consider park mandates and enabling legislation under changing conditions.</li> </ul>
Capacity Building	Indicators to Monitor
<ul style="list-style-type: none"> <li>Enhanced communication technology.</li> <li>Promoting climate change literacy: global vs. local impacts and implications.</li> <li>Build true interagency cooperation and collaboration with stakeholders. Consider structuring a coordinating entity to deal with the impacts of climate change (include agency, state, tribal, NGOs).</li> </ul>	<ul style="list-style-type: none"> <li>Relative sea level rise</li> <li>Geomorphology</li> <li>Species changes</li> <li>Groundwater</li> <li>Landscape level changes</li> <li>Vegetation phenology</li> </ul>

Climate Change Response Program: [www.nps.gov/climatechange](http://www.nps.gov/climatechange)

EXPERIENCE YOUR AMERICA™

# National Park Service







**National Park Service**



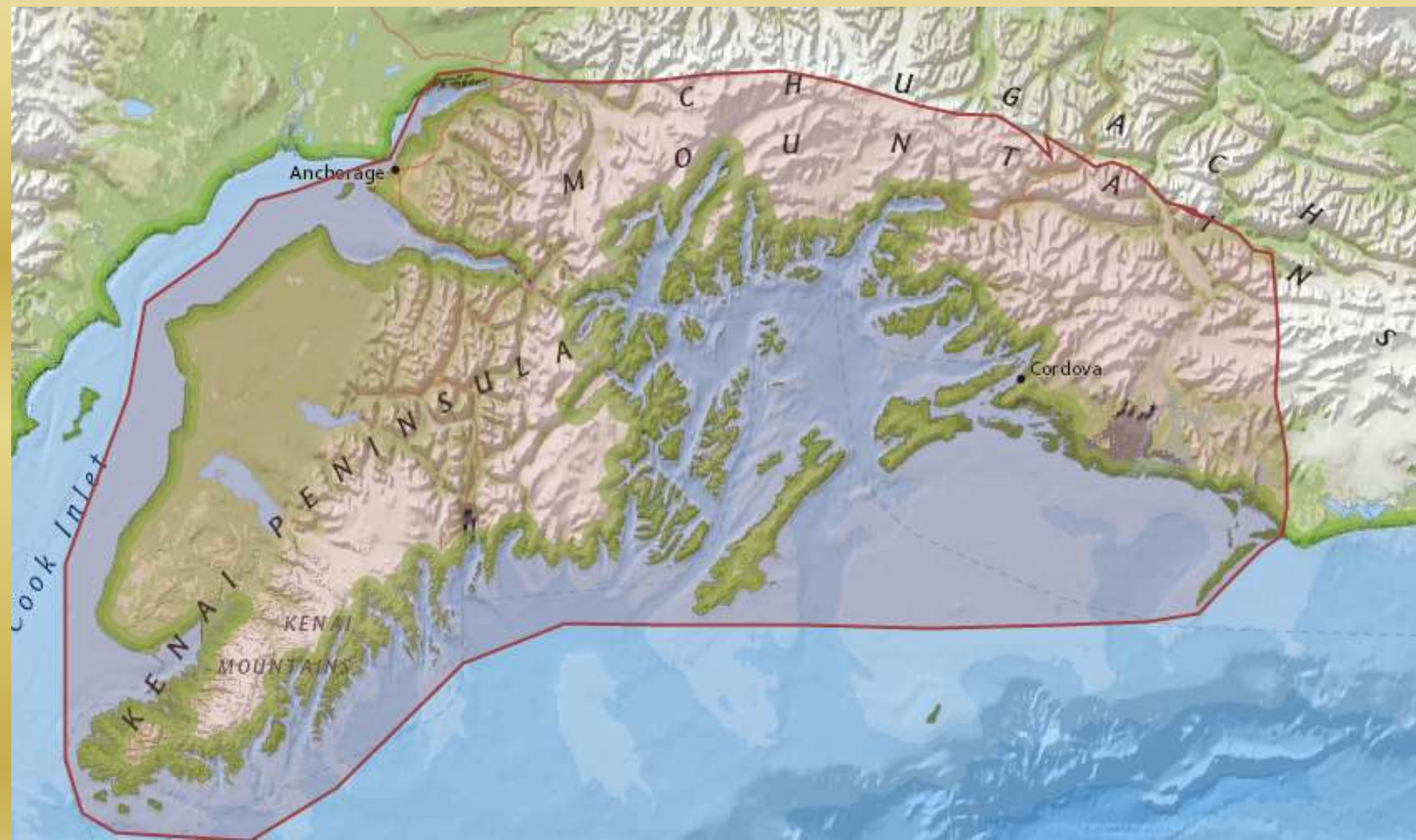




**National Park Service**







**National Park Service**

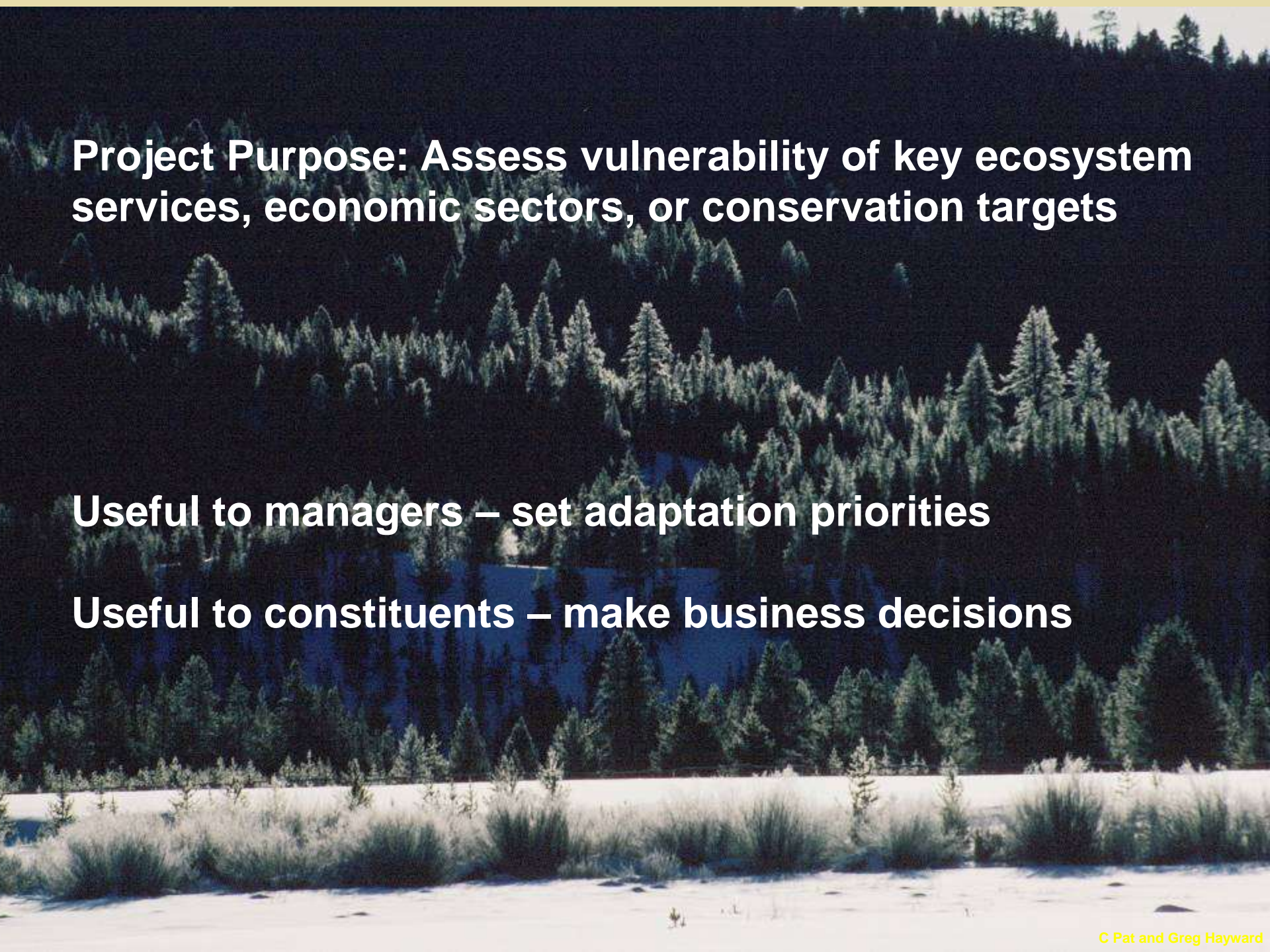




# **Chugach - Kenai Climate Vulnerability Assessment**

**University of Alaska, Anchorage  
Chugach National Forest, State and  
Private Forestry  
Kenai National Wildlife Refuge  
Forest Service Research - PNW  
Kenai Fjords National Park  
USGS Climate Science Center**



A scenic landscape photograph showing a dense forest of evergreen trees on a hillside. In the foreground, there is a sandy beach with patches of tall, dry grass. The text is overlaid on the upper portion of the image.

**Project Purpose: Assess vulnerability of key ecosystem services, economic sectors, or conservation targets**

**Useful to managers – set adaptation priorities**

**Useful to constituents – make business decisions**



# Five Emphasis Areas

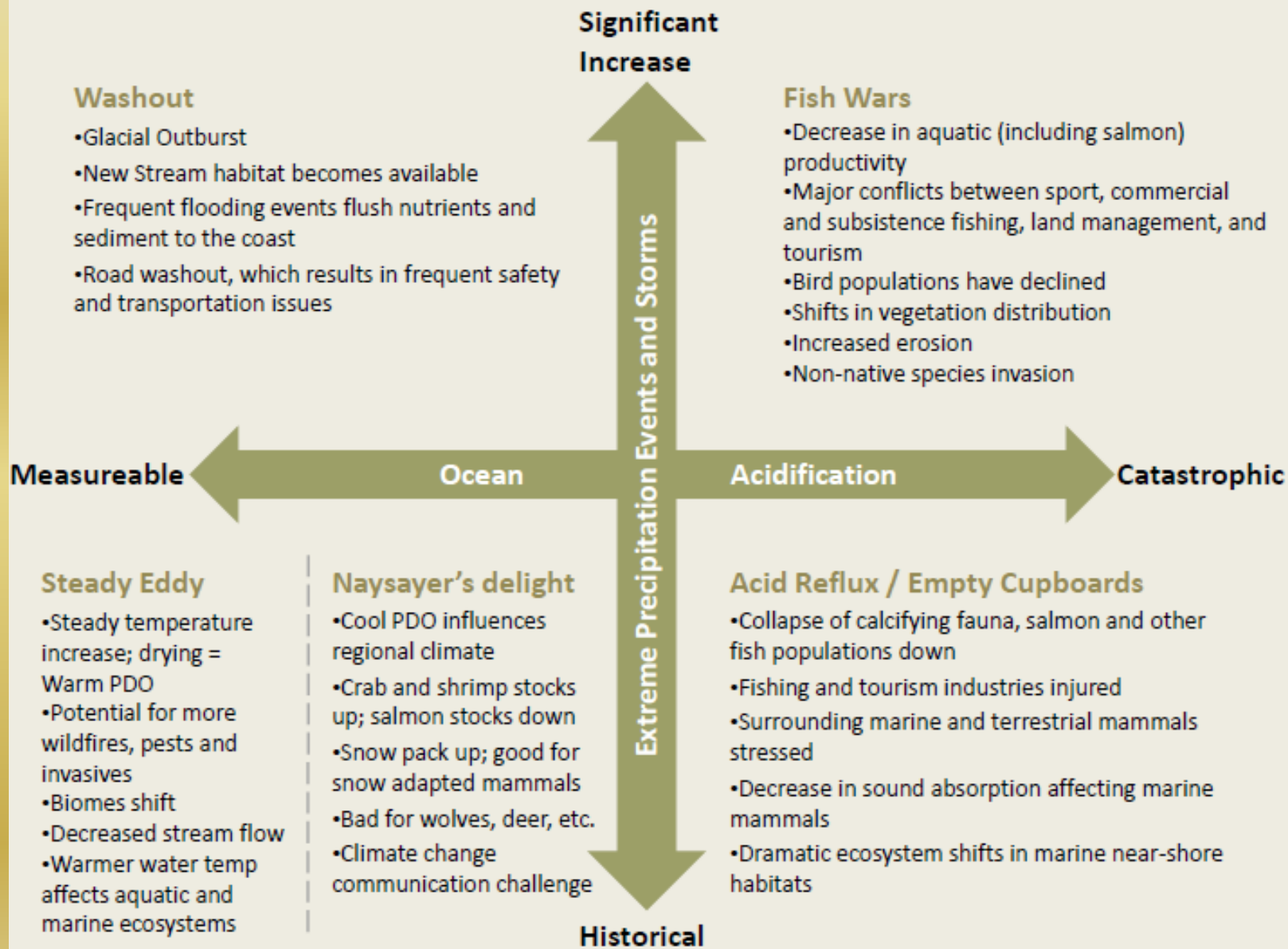
**Coasts and Sea-scapes** Tourism, productive systems

**Snow and Ice** Snow sports, visuals, hydrology...

**Culture and Infrastructure** Integrating team using results from other teams.

**Salmon** A defining ecological service of the region

**Vegetation and Species** Integrate -- biome shift, tree species shifts, dominant ungulates, invasive species.



# The Power of Place



Kenai Fjords National Park



Kenai National Wildlife Refuge

**National Park Service**





# Changing the Conversation about Climate Change



# Place-based Climate Change Education Partnership



Puget Sound



D.C. Area

South Florida & Keys





# Project Objectives

✓ Discover *current activities* at each site

✓ Identify *barriers & opportunities* for collaborating and communicating about climate change

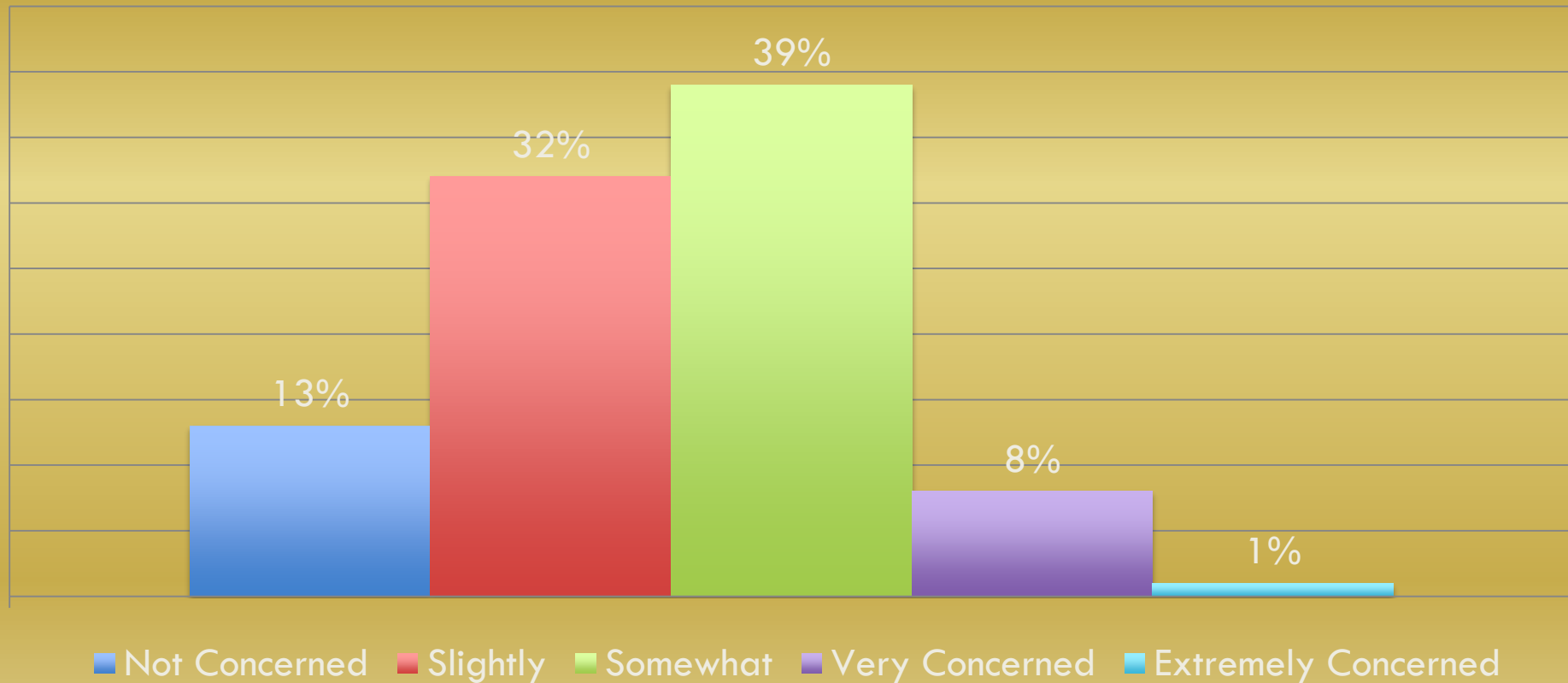
✓ Identify *issues & impacts* to be communicated

Integrate ideas for place-based climate change education/engagement strategy!

# Audience Research Results

## *Staff & Visitor Surveys*

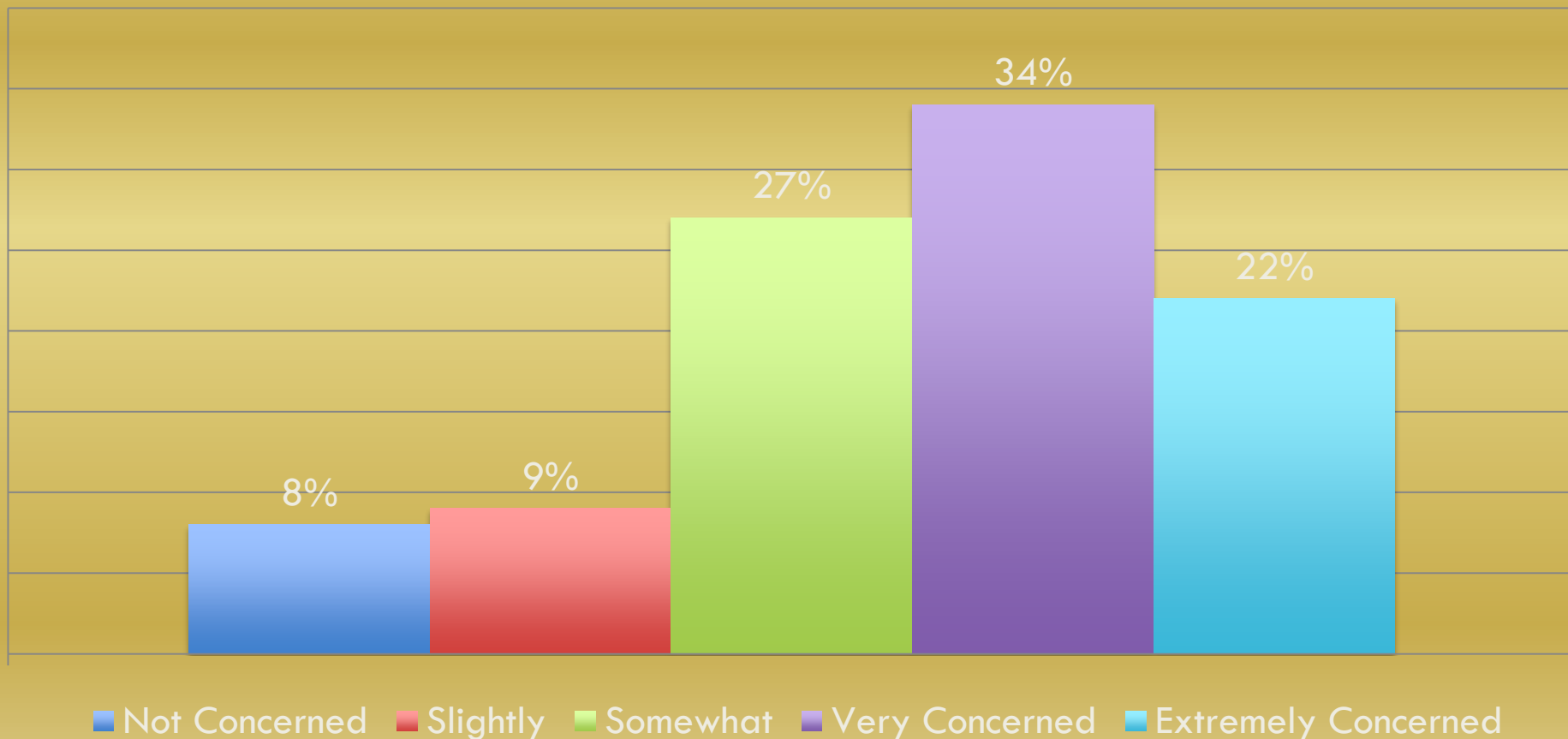
We asked the Staff: Are Your Visitors  
Concerned about Climate Change?



# Audience Research Results

## *Staff & Visitor Surveys*

Then we asked the Visitors: How  
Concerned are You about Climate Change?

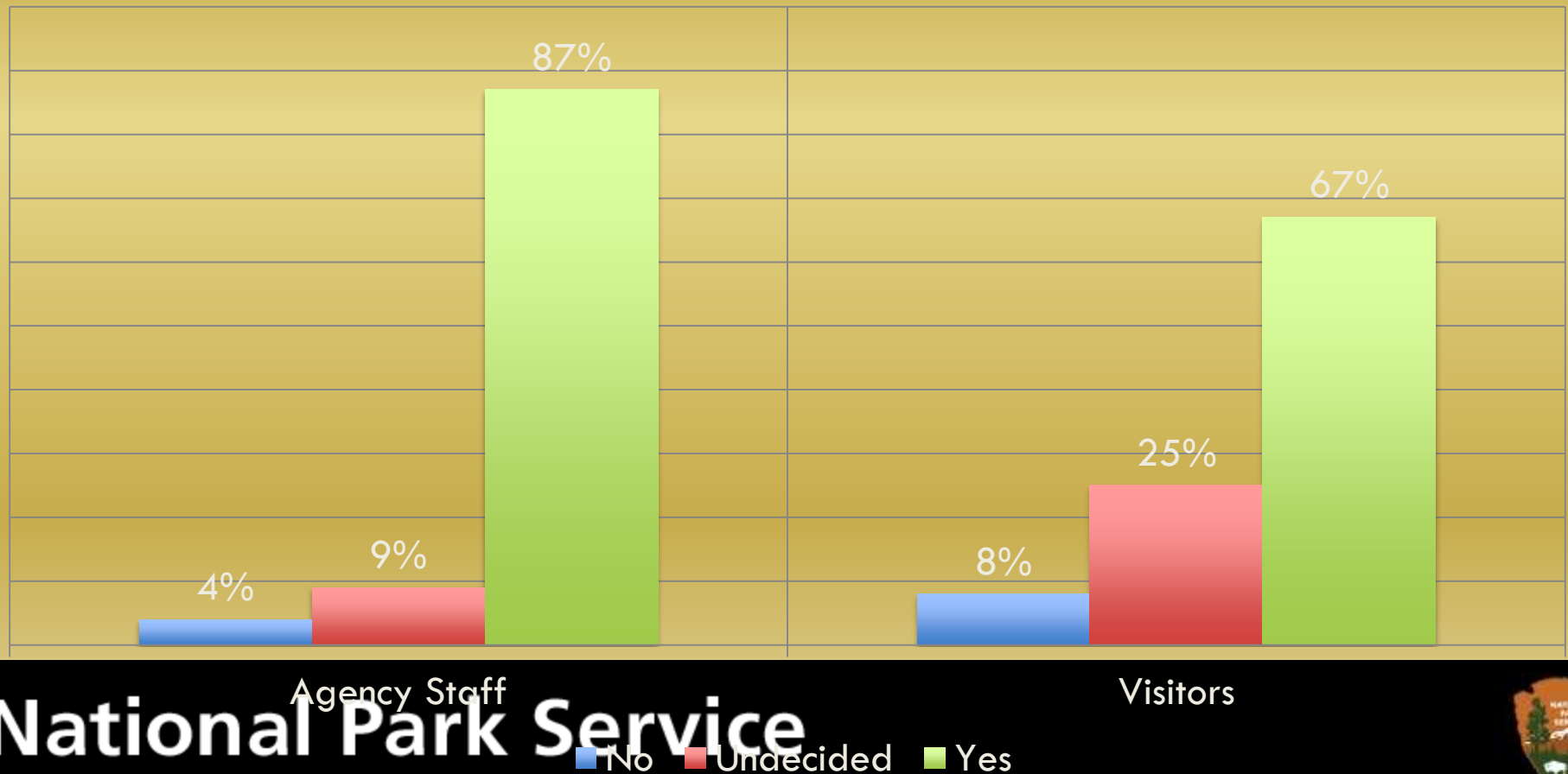




# Audience Research Results

## *Staff & Visitor Surveys*

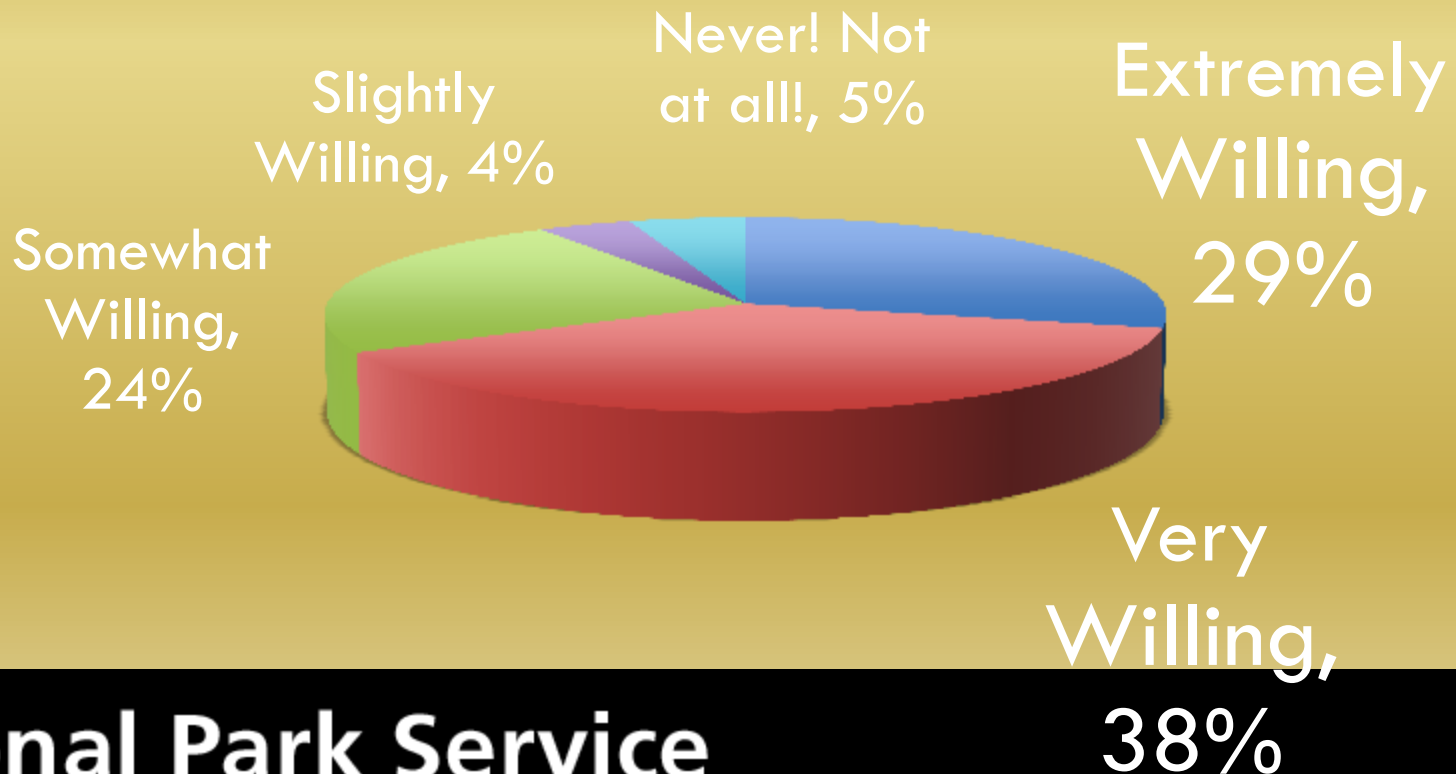
Should the National Parks and National Wildlife Refuges be Communicating about Climate Change with Visitors?



# Audience Research Results

## *Visitor Surveys*

Are you willing to change your behavior during your visit to help reduce the impacts of climate change at this place?



# Elements of the Kenai COP Project (Changing Landscapes)

Regional COP Coordinator (incl travel and admin support costs)

2-3 Interns to Support Project Needs

Developing Kenai Ranger Climate Change Hub

Scoping, Development and Evaluation of Training Modules for Agency  
and Partner (Guides, Visitor Services, Community) Staff

Scenario Planning Workshop for Kenai Peninsula Communities

Development of a Social Media Application for Sharing Climate Stories

Climate Education Programs for Youth Education



# Kenai Peninsula Climate Change Partnership

- Kenai Fjords National Park
- Kenai National Wildlife Refuge
- Chugach National Forest
- Kenai Watershed Forum
- Kenai Peninsula Borough??
- Seward, Soldotna, Kenai, Homer, Nikiski, Pt. Graham, English Bay, Seldovia...



# Assateague Island National Seashore

**Established in 1965**

**...to preserve the outstanding Mid-Atlantic coastal resources and natural ecosystem conditions and processes upon which they depend while providing high quality resource-compatible recreational opportunities.**



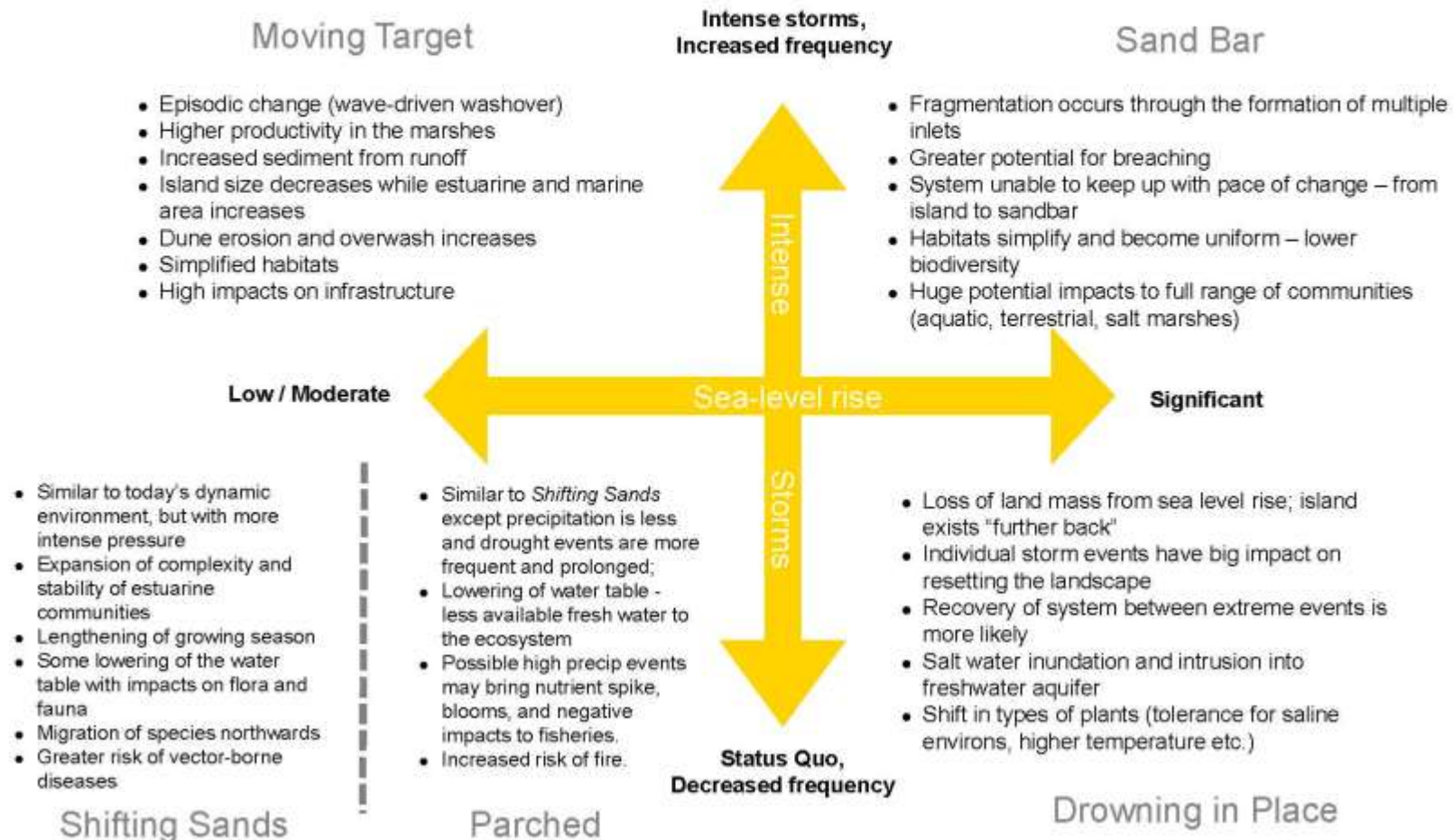
**National Park Service**



Climate Variable	General Change Expected	Confidence Level
Temperature	Increase, but not uniform	Virtually certain
Precipitation	Probable decrease in total annual precipitation	Low
Sea Level	Increase	Moderate
Drought	A modest increase in drought frequency in the warm season	Moderate
Snow cover	Increase in snow-free days; decreased snow accumulations	High
Length of growing season	Increase	High
Extreme Events: Temperature	Warm Events Increase / Cold Events Decrease	Moderate to high
Extreme Events: Precipitation	Possible decrease of frequency of heavy rain, but countered by rise in intensity.	Low to moderate
Extreme Events: Cold Season Storms	Increased intensity.	Low to moderate
Extreme Events: Warm Season Storms	Increased intensity; possible decrease in frequency	Low

# ASIS Local Scenario Framework

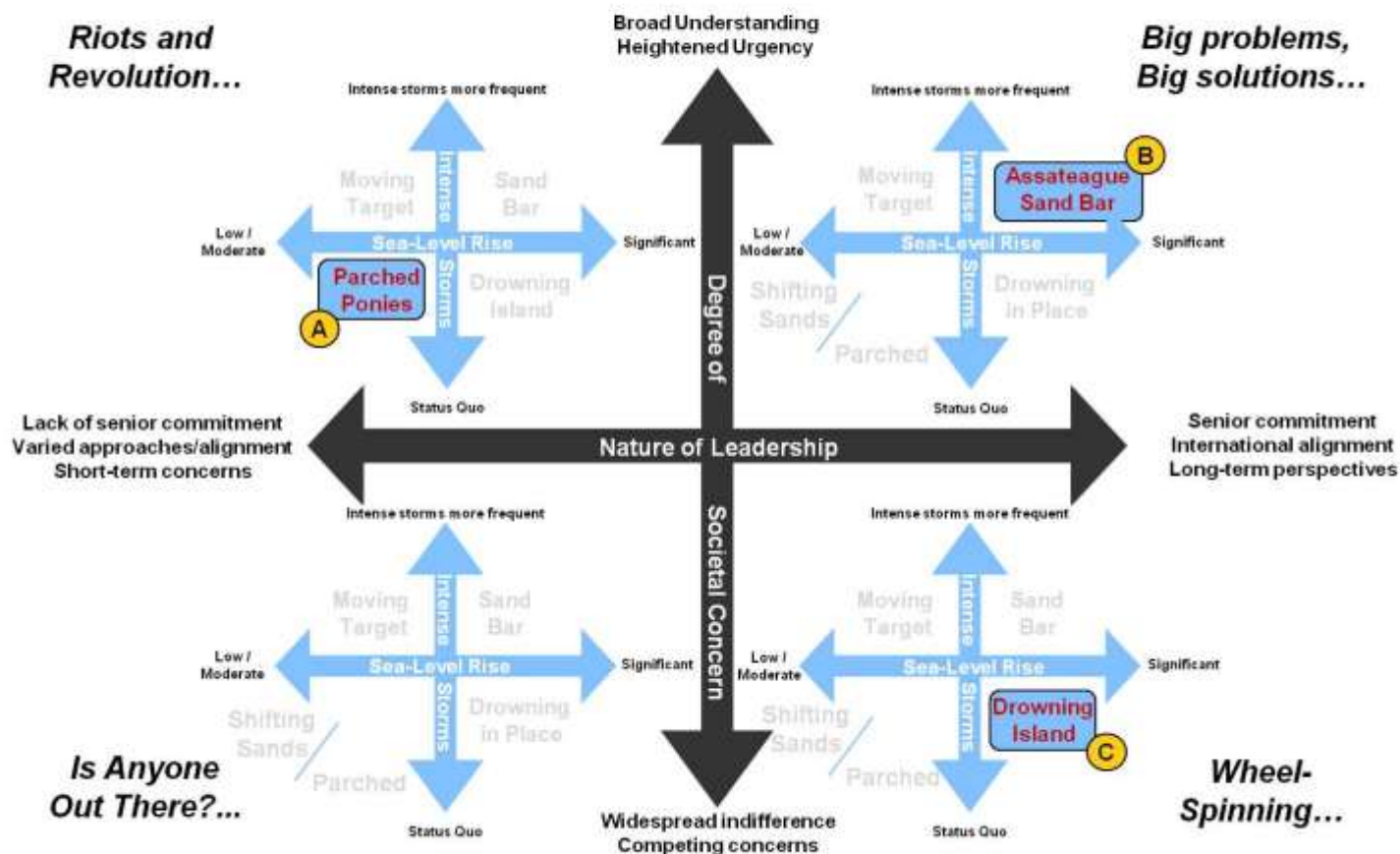
Through conversations before and during the April workshop, the ASIS team identified the most important and most uncertain climate drivers that will affect conditions in the Park over the next 40 years. The decided upon uncertainties relating to the intensity of storms and the rate of sea-level rise. These were combined in the following matrix.





# Case Study 1: ASIS Nested Scenarios

In the workshop, the ASIS team combined their local scenario framework with the high-level framework to create a set of "nested scenarios". They highlighted 3 nested scenarios (A, B, C) that seemed most important to consider further.



## High-Level Scenario

### Riots and Revolution

## Local Scenario

### Parched

*"Parched Ponies" is a world in which societal concerns around climate change are heightened, yet there is little real leadership shown to address challenges at a global or national level. At the same time, ASIS experiences a storm intensity similar to today and low/moderate sea-level rises. Additionally, precipitation drops, creating drought events that are more frequent and prolonged.*

- Lowering of the water table, leading to less available freshwater to the ecosystem
- The main impacts to the park under are migrating waterfowl, mammals, and declining or static shorebird habitat
- Resources changes include a smaller island, a shift from freshwater to brackish water (greater salinity), and more woody plant growth on beach areas.
- Possible high precipitation events may bring nutrient spike, blooms and negative impacts to fisheries.
- Impacts to plant and amphibian communities (especially those requiring freshwater and intolerant of warm water)
- Increased risk of fire
- Land use changes would require partnerships with other agencies, increased emphasis on coastal monitoring, an evaluation of the dune protection program, and greater land impact by ponies.
- Protection of resources would involve reprioritizing access needs and physically maintaining shorebird nesting habitat
- Monitoring capacity would need to be increased as would education and outreach.

# Trish Kicklighter – Interview - 2011

- ASIS is on the front lines of CC
- We're one storm breach away from the tipping point at which the entire islands breaks up
- CC is overarching to all our planning
- What we have now is not what we'll have in 20-30 years
- What we do for future managers...



# ASIS Management Actions

- Incorporate SP into ongoing GMP Process
- Rollout a Public Outreach Piece for SP
- Need to Monitor Groundwater – new protocol
- Two New Rules (No Regrets)
  - No more pavement on the island
  - Any new infrastructure on island must be portable



## PLANNING CONSIDERATIONS FOR THE ALTERNATIVES

### Natural Coastal Processes and Effects of Climate Change

Assateague Island is a barrier island that extends 37 miles along the coast of Maryland and Virginia and is part of a chain of barrier islands extending from Maine to Texas. Barrier islands like Assateague are highly dynamic places, in a state of constant change as currents and storms work to continuously reshape the land form and its habitats. Changing sea level and the availability of offshore sediments play vital roles in forming and maintaining these important coastal features.

Although long shore currents change course periodically throughout the year, sand is generally transported in a southerly direction along this part of the coast. On a seasonal basis, harsh winter weather pulls sand from dunes and upper beaches, depositing it into offshore sand bars and reducing beach width. This process is reversed during milder summer weather, as gentler wave action

acts to restore the shoreline. Assateague is also moving westward as a result of sea-level rise and coastal storms through a process called "island rollover." During severe storm events, sand is eroded from the ocean beaches and carried across the island by flood waters and re-deposited in the marshes and bay, gradually adding land to the island's western margin. These events can also break through dunes, spilling sand in fanlike deposits or even carving new tidal inlets, such as the one that has separated Assateague and Ocean City since 1933.

Most global climate change scenarios indicate that barrier islands such as Assateague will become much more dynamic as a result of accelerating rates of sea level rise, and more intense and possibly more frequent storms. The formation of breaches and new inlets during storm events has occurred repeatedly on Assateague, is very likely to occur again, and may occur more frequently if rates of sea level rise continue to accelerate as predicted. Depending upon the location, future breaches or new inlets may render portions of the island largely inaccessible. Additionally, a more dynamic barrier island landform will

Assateague Island National Seashore Climate Change Projections

CLIMATE VARIABLE	RANGE OF CHANGE EXPECTED BY 2040	SIZE OF EXPECTED CHANGE COMPARED TO RECENT CHANGES	CONFIDENCE
Temperature	↑ 1.8 to 3.5 °F	Moderate to Large	High
Sea Level	↑ 3.5 to 9 inches	Large	Moderate
Precipitation	↑ 1-6% in cold half ↓ 3 to 7% in warm half	Small to Moderate	Low to moderate
Extreme Weather:	↑ storm intensity ↑ summer drought ↑ rainfall intensity	Small to Moderate	Low to moderate

Intergovernmental Panel on Climate Change, 2007.

Please visit our website for additional information on climate change projections at Assateague Island

# Alternative 3

## SUSTAINABLE RECREATION AND CLIMATE CHANGE ADAPTATION

Climate change adaptation would play an increasingly important role in seashore management. Over time, the effects of natural coastal processes and climate change/sea level rise are expected to become the dominant force shaping the character of the Maryland developed visitor area. To minimize or avoid the damaging effects of natural coastal processes and climate change/sea level rise, visitor use infrastruc-

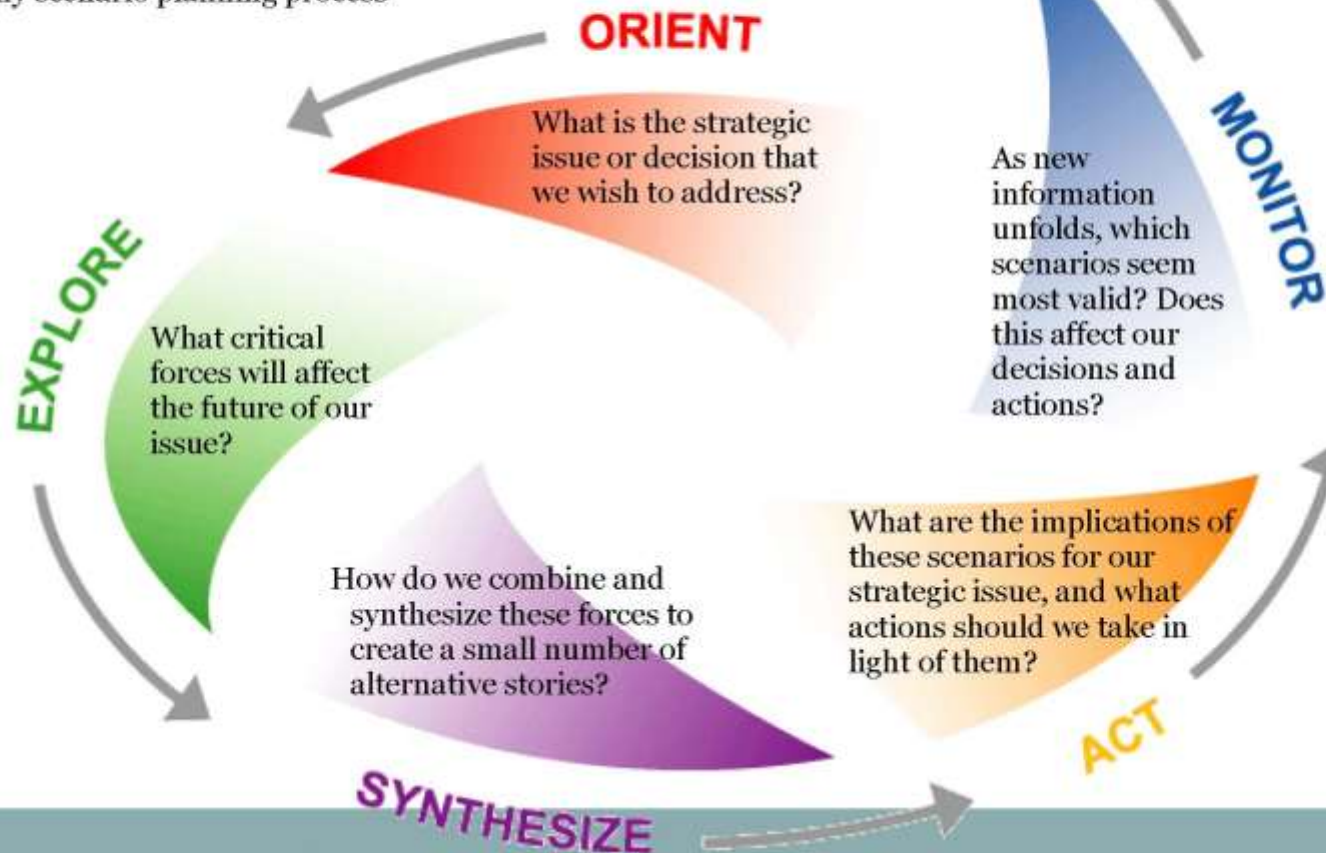
The NPS would continue to support beach oriented recreational activities in the Virginia developed visitor area through its agreement with the U.S. Fish and Wildlife Service.

Most recreational uses and activities in the Maryland portion of the seashore would be maintained on the island although, over time, the facilities and infrastructure



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# Southwest Alaska Network

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## Southwest Alaska Network Local Climate Drivers

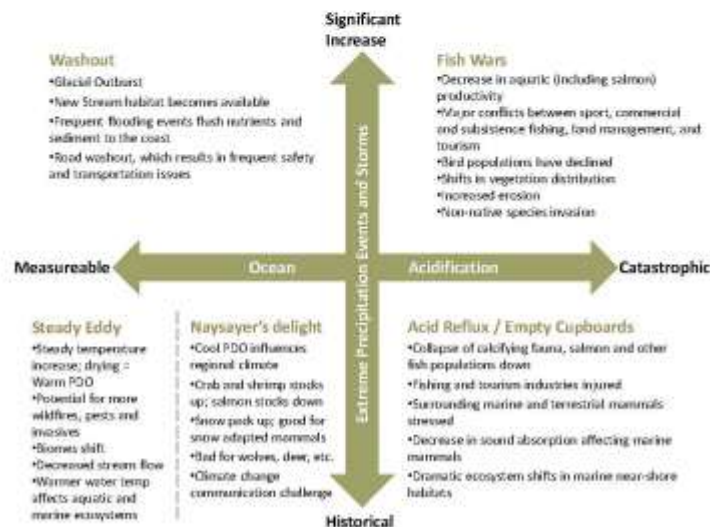
The Southwest Alaska Network scenario workshop participants identified extreme precipitation events and storms and ocean acidification as the most critical and uncertain climate drivers that will affect conditions in the network over the next 50 to 100 years. These drivers were used to create a local climate change drivers matrix where impacts to park resources and infrastructure could be identified and elevated for additional consideration. Based on the local climate drivers matrix, four narrative scenarios were developed, which incorporate the potential impacts of climate change to park resources set in the context of varying future social and political situations.

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April 2011





# “Best Practices” Management Actions Common and Applicable to All Scenarios

## Resiliency

- Make Climate Change an organizing principle for park priorities.
- Reduce stressors: control invasives, restore disturbed areas.
- Coordinate emphasis on inventory and monitoring of both social and natural systems.

# “Best Practices” Management Actions Common and Applicable to All Scenarios

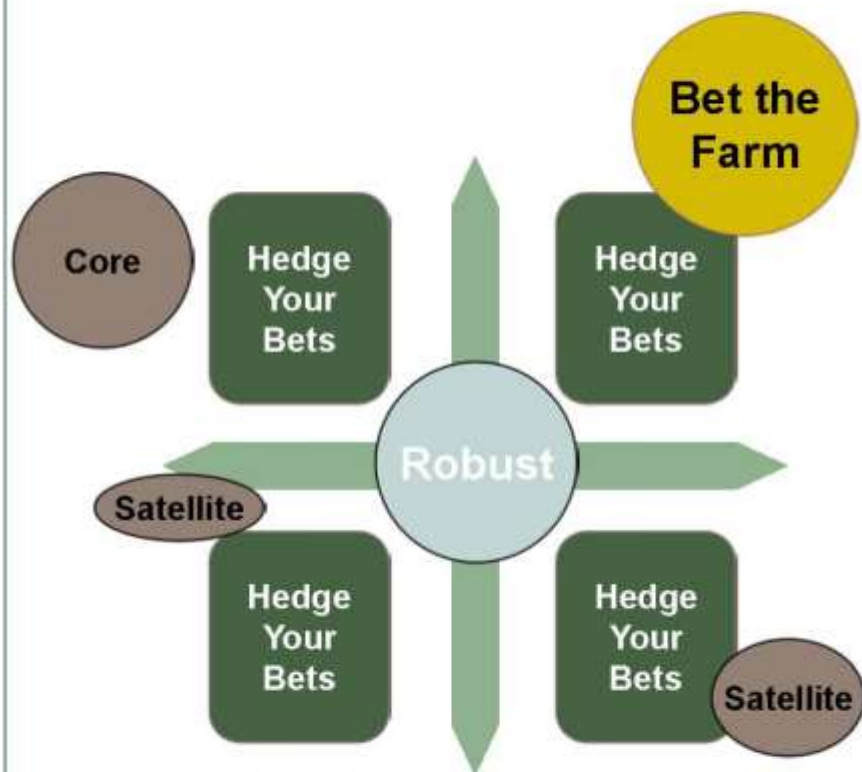
## Research and Study

- Safety and access changes.
- Role of natural variability.
- Park relevance with public and visitors under changing conditions.
- Consider park mandates and enabling legislation under changing conditions.

# “Best Practices” Management Actions Common and Applicable to All Scenarios

## Capacity Building

- Enhanced communication technology.
- Promoting climate change literacy: global vs. local impacts and implications.
- Build true interagency cooperation and collaboration with stakeholders. Consider structuring a coordinating entity to deal with the impacts of climate change (include agency, state, tribal, NGO's).



**Robust:** Pursue only those options that would work out well (or at least not hurt you too much) in any of the four scenarios

OR

**Bet the Farm / Shaping:** Make one clear bet that a certain future will happen — and then do everything you can to help make that scenario a reality

OR

**Hedge Your Bets / Wait and See:** Make several distinct bets of relatively equal size

OR

**Core / Satellite:** Place one major bet, with one or more small bets as a hedge against uncertainty, experiments, and real options

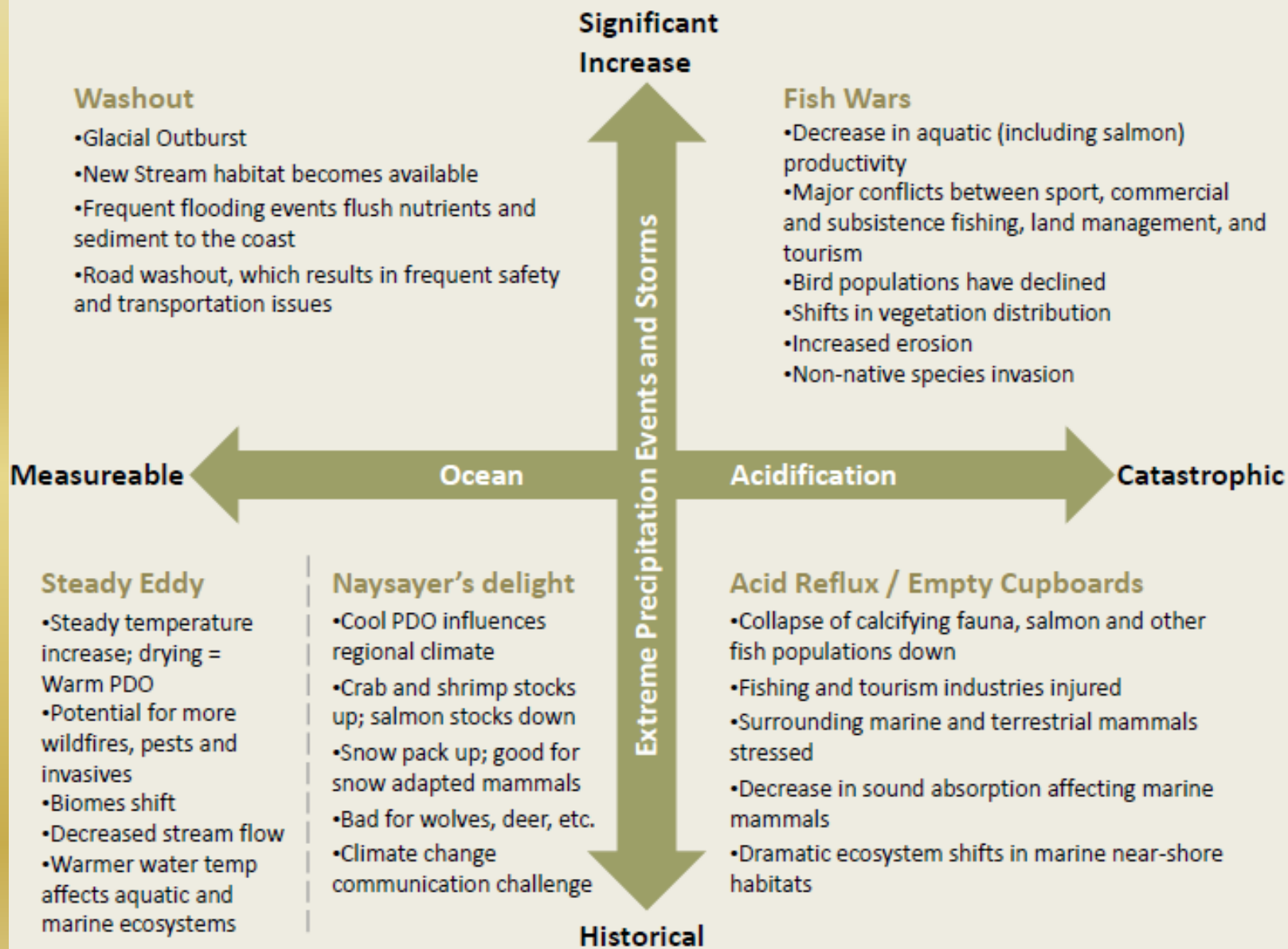


# Questions?



**National Park Service**





# “Best Practices” Management Actions Common and Applicable to All Scenarios

## Indicators to Monitor

- Relative sea level rise
- Geomorphology
- Species changes
- Groundwater
- Landscape level changes
- Migration phenology

# Climate Change Education Partnership (NSF – CSU, NPCA, NPS, FWS)



## National Park Service

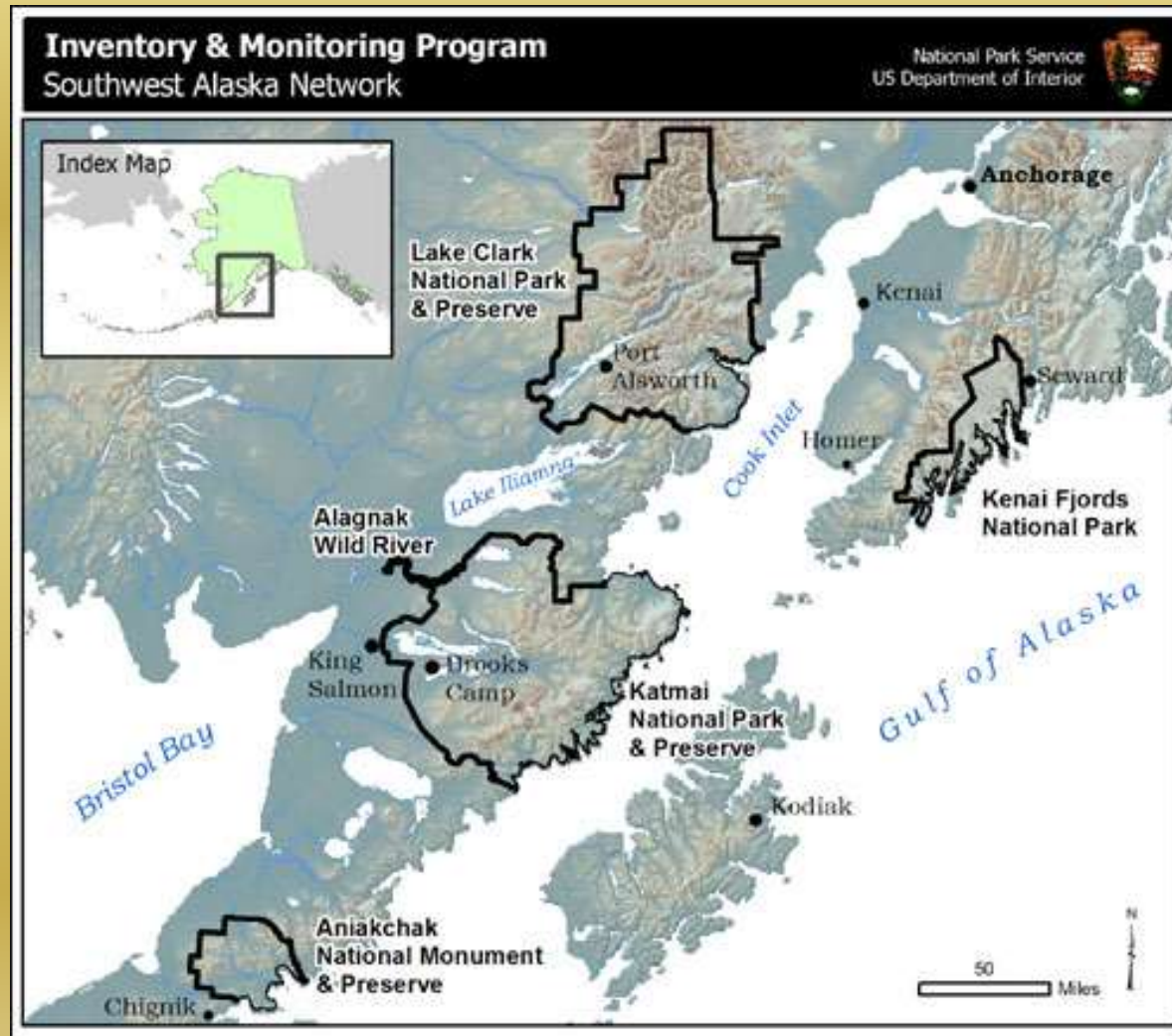




# Kenai Peninsula Climate Change Education Partnership - (NPS, FWS, NPCA, USFS, KWF)



# Southwest Alaska Network (SWAN)



**National Park Service**



# SWAN Parks and Sites



**Aniakchak**



**Lake Clark**



**Kenai Fjords**



**Katmai**

# Selected Drivers (Coastal)

Climate Drivers (or, "Scenario Drivers based on Climate")	Uncertain	High certainty	Important
Temperature	X		X
Precipitation	X		X
Freeze-up		X	
Length of growing season		X	
Sea Level	X		
Water availability	X		
Relative Humidity	X		
Wind Speed (separate from Aleutian Low)	X (duration)	X (increase)	
PDO	X		
Extreme Events (temperature)		X	
Extreme Events (precipitation)	X	X	
Extreme Events (storms)		X	X

**Selected drivers to explore:**

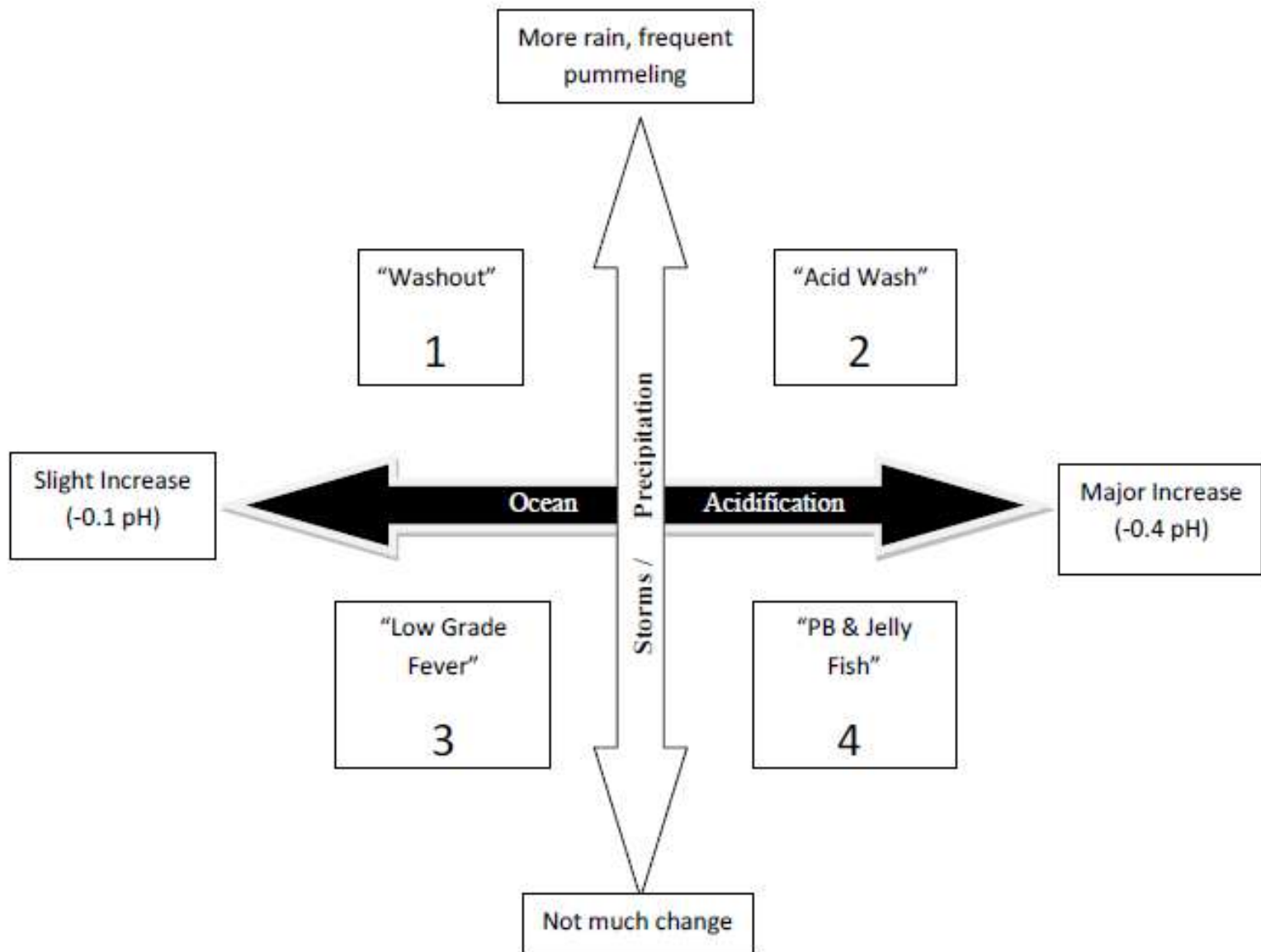
***Acidification:  
Temperature:  
Storms***

***Precip***

**Additional drivers introduced by the group:**

- **Ocean Acidification**
- **Salinity (onshore/near shore)**
- **Aleutian Low**
- **Extreme Event (wind)**
- **AK Coastal Current**







**National Park Service**





**National Park Service**







**National Park Service**







**National Park Service**







**National Park Service**





**National Park Service**





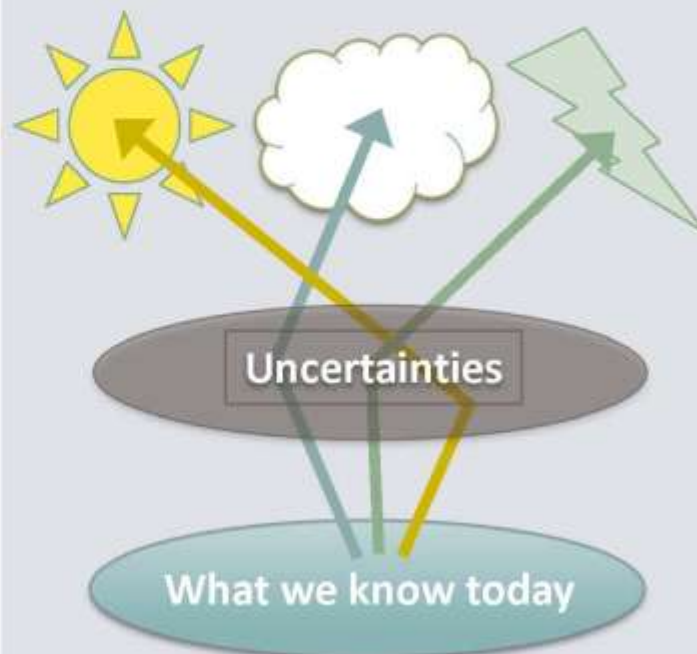
# Scenario Planning vs. Forecasting

- *Scenarios overcome the tendency to predict, allowing us to see multiple possibilities for the future*

- Forecast Planning
- One Future

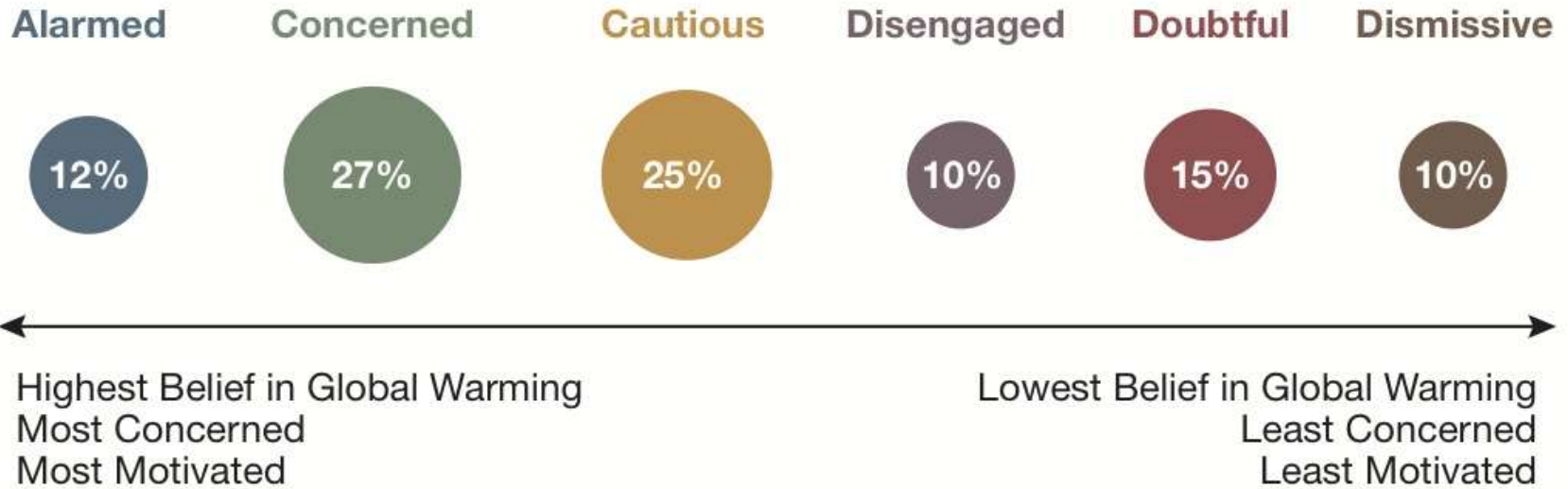


- Scenario Planning
- Multiple Futures





May  
2011  
n=981

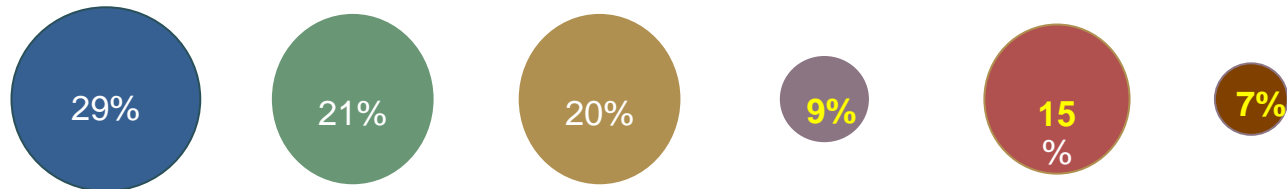


*Proportion represented by area*

Source: Yale / George Mason University

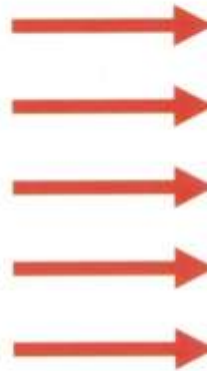
Autumn

Jan - Dec  
2011  
n = 4,136



**Implications**  
*The conditions under which you will need to operate*

Challenges  
Bottlenecks  
Shortages  
Emergent needs  
Emergent capabilities



**Options**  
*The range of actions you will take in light of the conditions*

Responses  
Workarounds and fixes  
New supplies and suppliers  
Product or service offerings  
Specific investments, development activities